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MISCELLANEOUS QUESTIONS.

Edited by R. D. Carmichael.

Professor F. R. Moulton, of the University of Chicago, calls attention to the fact that the differential equation proposed by Mr. Louis Cohen (see our question 1 in the January issue) belongs to the class given general treatment by him and Dr. W. D. MacMillan in the American Journal of Mathematics, volume 33, pages 63 and 96.

For question 4, proposed in the issue of December, 1913, we need more comprehensive answers than any yet received. We have in hand an excellent reply to question 6; the topic suggested in it is of such interest, however, that several answers are desirable.

Question.

10. What use has been made of regular conference periods for assistance to individual students of secondary and college mathematics, and what services may they render?

Reply.

5. In what ways may mathematics contribute most to the culture of the individual? What is being done and what may be done to advantage in the matter of developing courses in culture mathematics?

I. Remarks by D. N. Lehmer, University of California.

There is, no doubt, a strong prejudice in the minds of many mathematicians against culture courses in mathematics. The phrase is often understood to apply to courses in which there is no attempt to insist on accurate thinking, and where the emphasis is laid not so much on mathematics as upon stories connected with mathematics. The student will learn what an extraordinary amount of time and attention was given by the Alexandrian Greeks to the problem of the trisection of an angle, but he will not know accurately what the problem really meant. As to the reason why their efforts were foredoomed to meet with failure, and just what was the difficulty with which they struggled, these matters will be passed over in haste and perhaps in silence. He will be familiar with all of the great names in mathematics, but he will not have a single clear idea of any of the problems which engaged their attention. These are the "culture courses" that have made the very name an abomination to thoughtful teachers.

The history of mathematics is a great and important subject, but any course based chiefly on that subject will almost certainly be a waste of time for the serious student. The result is not mathematical training at all, but an attempt at historical training and that in a domain where we have not yet developed the rigorous discipline to be found in some subjects. We are all of us familiar with the superficial talker who can converse fluently on the most abstruse subjects without having one clear idea in his head about them. Why should we go to the trouble to plan a course for the development and encouragement of just such creatures?

But there are students whose chief interests lie in other branches of science who would nevertheless like to have an adequate notion of the state of affairs in mathematics. The number of such students is not so small as some people may imagine, and there are enough of them who are ready to go to some trouble in applying themselves to the study to make it worth while to plan a course that shall not be microscopic, nor yet telescopic, and which shall put them in possession of the most important processes and developments of the subject. Such a course has been given at the University of California for a number of years, and while each class has been made the subject of careful experiment, the courses as a whole have been pretty much the same from year to year.

The importance of the notion of one-to-one correspondence in all branches of knowledge would seem to demand that the relation between algebra and geometry be made clear to all serious students. Accordingly it is usual to start the years' work with a drill in the fundamental notions in analytic geometry. The students are freshmen and some may be lacking in trigonometry, but it is possible to teach analytic geometry with a very little trigonometry, and such as is absolutely essential can be supplied in a week or two as is necessary. The circle and conic sections are touched on very lightly, if at all, and progress is made towards the notion of the calculus by means of curves defined by equations of the form $y =$ polynomial in x. Such curves are especially useful in introducing the idea of the derivative, maxima and minima, inflection points, integration and evaluation of areas, volumes, etc. It is believed that it is of considerable importance that the student get the fundamental notions of the calculus with a minimum of effort in the way of actual manipulation of analytic expressions. Even the formal notation used in books on the calculus would seem to be of secondary importance. A student may emerge from such a course never having heard of a reduction formula, but he will know how to state a problem in finding areas or volumes in such a way that it will mean for him the discovery of an anti-derivative.

The course lasts for the whole year, three hours per week. It is possible with some classes to develop certain other ideas such as the foundations of number, or the processes of synthetic projective geometry. The chief emphasis is laid, however, on the principles of the calculus. It is in no sense a "snap" course, and its success is abundantly vouched for in the number of those who come to taste and remain to pursue the subject through the rest of their college career.

This is our notion of a "culture course," and while it is sometimes thought of by the ill-informed as a "hodge-podge" because we do not separate trigonometry and analytic geometry and the calculus into water-tight compartments, it serves the purpose of informing the student of the most important processes of modern mathematics, and at the same time demands from him his utmost efforts.